Alternative: Conjunctive Use of Surface and Groundwater

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1. Summary of the Alternative

Conjunctive management allows water managers to use a combination of surface water and groundwater resources to meet demand. For purposes of this white paper, conjunctive management does not include injection of surface water into the aquifer for storage and retrieval at a later time (which is being discussed in a separate white paper [DBS&A, 2002a]) but simply means combined use of surface and groundwater rights.

Conjunctive use of the two types of rights would allow water rights holders who own both surface water and groundwater rights to rely entirely on surface water in wet year while allowing the aquifer to recover through natural recharge. When surface water is less available, water suppliers can then rely on groundwater and forgo diverting their surface water rights. This would benefit the river system and downstream users by leaving additional water in the river in times of drought. Over time, conjunctive management can benefit the region by providing flexibility to switch from groundwater to surface water supplies depending on availability. Conjunctive management can also address water quality issues. By mixing poor-quality water with higher-quality water, expensive treatment options may be somewhat reduced.

Conjunctive use will help protect existing supplies by improving the sustainability of the resource. Conjunctive use will not increase the supply for meeting the growing demand in the region.

In the Jemez y Sangre region, conjunctive management could represent a tool for water resource managers to take advantage of spring snowmelt runoff and heavy precipitation during the summer "monsoon" months. Water entities with both groundwater and surface water rights would greatly benefit from the ability to extract all the water rights from the most available

source of supply. Under the current system, water rights are generally restricted to the point of diversion (either the well or the surface water diversion). For example, groundwater rights must be extracted from the permitted well and cannot be taken from a surface water diversion. Similarly, surface water rights can be diverted at the surface water point of diversion and may be limited by available supply. This means that water suppliers with surface water rights are limited in times of drought and may not be able to use all their water rights.

As an example of how conjunctive management can enhance water resource availability in the region, assume a water supplier with 100 acre-feet of surface water rights and 100 acre-feet of groundwater rights, who must meet a demand of 200 acre-feet of water per year. If the water supplier cannot manage these water rights conjunctively, it may not be able to use its full water rights in drier years because of limitations in surface water availability. If, however, the water rights holder is allowed to take all 200 acre-feet per year of water from surface supplies in a particularly wet year, the aquifer would be allowed to recharge naturally, which would help maintain water levels. In a drier year, instead of forgoing a portion of its water right (or the entire water right if it's a junior water right) and failing to meet demand, the entity could divert the entire 200 acre-feet from groundwater. This would allow the supplier to meet demand while leaving additional water in the river for downstream users.

2. Technical Feasibility

In cases where a water rights holder already is using both surface water and groundwater supplies, such as the City of Santa Fe, there should not be any significant technical issues regarding conjunctive management of the two supplies. Because existing infrastructure and treatment capacity may be limited and therefore unable to accommodate increased water diversions and treatment, conjunctive use of surface and groundwater would be the means to obtain sufficient water to meet already existing demand (for which capacity would already exist) rather than increasing the amount of water in the system.

Gaging of the surface water supply (streamflow and snow pack) and monitoring of reservoir stage will be required to determine whether more or less surface water should be used in a

given year; in many cases, this information is already being collected. Additionally, monitoring of groundwater levels will also be valuable to evaluate the effects of the conjunctive management on the aquifer.

In locations where only groundwater is used, purchase of surface water rights and the installation of a surface diversion would be required. For example, Española currently uses only groundwater for its municipal water supply, but is investigating a surface diversion to use San Juan-Chama Project water. It is technically feasible to install surface diversions, but additional costs and environmental issues may arise.

Conversely, if acequias that only use surface water want to supplement their supply during drought periods, wells would need to be installed. The feasibility of well installation is dependent on local geologic conditions. Wells are widely used throughout the Jemez y Sangre region and in most locations wells could be installed, if Office of the State Engineer (OSE) approval for conjunctive management and additional water rights were obtained. Additional discussion regarding the feasibility and costs of installing wells is provided in a separate white paper (DBS&A, 2002b).

To obtain Office of the State Engineer (OSE) approval for conjunctive management, the water rights holder would apply for a change in point of diversion under certain conditions. The applicant would need to show that this change in management would not result in impairment to existing users. Supporting technical analyses, including extensive modeling of stream-aquifer interaction, would be required, particularly regarding:

- The effects on the river and other groundwater users due to pumping more in dry years
- The impacts on the river system and other users due to greater surface withdrawals in wet years

3. Financial Feasibility

Where a water rights holder is already using both surface water and groundwater supplies, there should be no significant financial implications due to managing the water rights conjunctively, and this alternative may even result in long-term cost savings. The costs for initiating this program would include filing and obtaining OSE approval of an application and possibly ongoing monitoring costs. Obtaining OSE approval would entail fees for legal counsel unless the applying entity is prepared to internally submit the application.

Technical studies showing the connection between surface and groundwater, and possibly models illustrating the potential impacts of this type of management would most likely also be required to obtain OSE approval. Combined legal and technical studies to obtain OSE approval could possibly be completed for $100,000 to $200,000; however, if extensive modeling is required and/or contested legal issues are present, implementing this alternative could cost up to $1 million or more. Potential funding sources for analysis of surface and groundwater supplies include the U.S. Environmental Protection Agency (EPA), Bureau of Reclamation, and Community Development Block Grants. Funding from these sources could possibly be used for monitoring programs as well.

For entities that would need to install municipal supply wells, typically costs are approximately $300 to $600 per foot, depending on well depth, diameter, and capacity. These costs cover full well completion but do not include costs for pump, well house, pressure tank, and other peripherals, nor for surface infrastructure, which if not already in place, will add costs that may be even greater than the well cost. The cost of a surface diversion is dependent on the size and location. Raw water conveyance and treatment and treated water transmission facilities could also be required. Finally, treatment costs could be higher if greater capacity is needed to treat greater quantities of surface water in wet years.

4. Legal Feasibility

The conjunctive use of surface water and groundwater in the Jemez y Sangre planning region could potentially allow for the optimum use of all water sources in the region. An example of a conjunctive use regime can be understood in light of the City Of Santa Fe's water rights. Under a conjunctive use scheme, all of the City's water rights would be inventoried and a maximum amount of water determined, with a certain percentage of water consisting of permitted groundwater rights and a certain percentage consisting of the surface water available for use by the City. With conjunctive use, the City could plan to use a higher percentage of surface water in those years where surface flows are available and a higher percentage of groundwater in those years where surface flows are minimal. The total maximum amount the City could use in any given year would always remain the same, but the City would have the flexibility to use its surface and groundwater in a manner which would maximize the amount available to the City at any given time.

The State Engineer has the power, through permit conditions, to allow the commingling of water rights and the conjunctive use of water. In order for new permit conditions to be implemented, a permit holder would have to apply for such changes with the State Engineer and go through the process of notice and publication. In examining any such proposed permit conditions, the State Engineer would permit such conditions if they did not impair existing water rights and were not contrary to the conservation of water or detrimental to the public welfare. Also, in permitting the conjunctive use of surface water and groundwater, the State Engineer may limit the amount of surface water available for such use to the historical supply of such surface water.

The adjudication process in District Court can also create a mechanism for conjunctive management in small watersheds. The Aamodt case, which covers water rights claims in the Pojoaque Valley, has set up a system for conjunctively managing water rights.

Besides complying with the conditions of permits, a water right holder contemplating the conjunctive use of water must also ensure that such use is not subject to any constraints by an adjudication court or any limitations under the Rio Grande Compact. Since New Mexico's

delivery obligations are based on flows at the Otowi gage, the OSE and Interstate Stream Commission (ISC) would have to determine whether exercising this alternative would affect the Compact.

One issue that may arise in considering the conjunctive use of water is that of priority administration of the surface and groundwater that is being conjunctively used. In the Rio Grande Basin, groundwater is hydrologically interconnected to surface water. This presents a problem in priority administration because of the delayed hydrologic effects from pumping wells. For instance, when water is withdrawn by a well from an aquifer that is interconnected with a stream system, the well initially draws water from underground storage and has no effect on stream flow. However, as groundwater in storage is depleted over time, the well eventually begins to draw water from the stream system, resulting in decreased surface flow.

There is also a delay in impact when a groundwater appropriator ceases pumping a well. The impact from prior pumping on the stream system will continue until the depleted groundwater is substantially replaced. The time for impacts from well pumping to be realized on a stream system varies greatly and is usually directly related to the distance of the well from the stream. The effects from a well located immediately adjacent to a stream may be felt immediately. On the other hand, it could be years or even decades before impacts on surface flow would result from pumping a well located several miles from the stream.

The delay in impact from well pumping creates the problem in priority administration. When a senior surface water user is not receiving his full appropriation and "calls" the river, it would be expected that well appropriators with water rights junior to those of the surface appropriator would cease pumping. However, due to the delayed effect on the stream system from cessation of well pumping, curtailment of pumping from wells would result in no additional water for the senior appropriator. This situation can occur often because well rights are often junior to surface rights simply because early appropriators acquired surface water rights and the groundwater appropriators came later.

As might be expected, the futile call doctrine comes into play when a senior surface water appropriator calls the river and there are junior well rights on the stream system. Cessation of

well pumping would result in no additional water for the senior; therefore, the junior wells could continue pumping. Such a result is contrary to the spirit of the prior appropriation doctrine, which requires that senior water rights holders fulfill their rights prior to junior water rights holders.

The State of Colorado has attempted to deal with priority administration of surface and ground water through legislation regulating "tributary ground water" (water that is hydrologically connected to a surface stream system) conjunctively with surface water. Through this legislation, Colorado has attempted to balance priority administration with the maximum utilization doctrine. Colorado's 1969 Water Right Determination and Administration Act declared that "[I]t is the policy of this state to integrate the appropriation, use, and administration of underground water tributary to a stream with the use of surface water in such a way as to maximize the beneficial use of all of the waters of the state" (Colo. Rev. Stat. §37-92-102(1)(a) (1997)). This policy recognizes that utilizing groundwater maximizes beneficial use because it uses stored groundwater that would otherwise not be beneficially used.

Colorado's statutes expressly protect senior surface rights from junior well appropriators. "[T]he operation of this section shall not be used to allow ground water withdrawal which would deprive senior surface rights of the amount of water to which said surface rights would have been entitled in the absence of such ground water withdrawal . . ." (Colo. Rev. Stat. §37-92-102(1)(a) (1997)). This same statute, however, also codifies the futile call doctrine as follows:

> [A]nd that ground water diversions shall not be curtailed nor required to replace water withdrawn, for the benefit of surface right priorities, even though such surface right priorities be senior in priority date, when, assuming the absence of groundwater withdrawal by junior priorities, water would not have been available for diversion by such surface right under the priority system. (Colo. Stat. §37-92-501)

Finally, Colorado provides for augmentation plans to offset depletions from wells. Wells that make out-of-priority diversions must replace their depletions through an augmentation plan. An essential component of an augmentation plan is to provide sufficient replacement water to

prevent injury to senior appropriators (Colo. Rev. Stat. §37-92-305(5)). The process is similar to New Mexico's provisions for retiring water rights to offset depletions to surface water.

5. Effectiveness in Either Increasing the Available Supply or Reducing the Projected Demand

This alternative will not result in an overall increase in water rights, as it involves already allocated water rights that are currently available but cannot be exceeded. However, conjunctive management of existing water rights would effectively increase the usable supply by making a groundwater supply available during a drought when surface water would be otherwise unavailable. Due to local hydrologic and water rights factors, the Santa Fe, Española, and Pojoaque/Nambe areas would likely benefit the most from implementing this alternative.

6. Environmental Implications

Several environmental benefits are associated with conjunctive management:

- If stormflow is diverted as part of the conjunctive use strategy, potential slowing of summer stormflows could reduce erosion and runoff. However, any changes in flows should be examined for specific local environmental impacts.

- A water user taking advantage of a conjunctive use program will abstain from diverting in times of severe drought. This will benefit aquatic species in that the in-stream flow will be higher than it would otherwise have been.

7. Socioeconomic Impacts

Strategic conjunctive use of groundwater and surface water has many potential benefits, the foremost of which is improving water supply stability between wet and dry years. With conjunctive use, water providers can spend less on acquiring buffer supplies against dry years. If conjunctive use is implemented across multiple regional water providers, costs per unit of firm

water supply can be lower for well fields and surface diversions. In addition, conjunctive use and regional water banks work well together as complementary mechanisms for coordinating among water users with differing combinations of surface water and groundwater rights who face differing exposures to dry year shortages.

Conjunctive use entails potential costs as well as benefits. If new well fields are necessary, groundwater tables and surface flows will be impacted to some degree. Conjunctive use requires detailed surface water supply assessments and groundwater monitoring, along with their attendant costs. Legal and technical expertise is needed to establish the appropriate procedures and criteria for implementing conjunctive use, consistent with OSE policies. New water storage and conveyance infrastructure may be necessary to accomplish regional conjunctive use, depending on how it is implemented.

Community and social impacts depend on the manner in which conjunctive use is accomplished. There is potential for disruption of local areas selected for infrastructure construction. However, conjunctive use can produce significant cost savings, potentially freeing up funds for other community needs.

Although the objective of conjunctive use is to create stable water supplies and a buffer against drought, it may inadvertently encourage growth in that water suppliers using their rights conjunctively could continue pumping groundwater in wet years to meet increasing demand. This result would diminish the usefulness of this alternative to alleviate water supply problems during times of drought. However, this is unlikely to occur because the OSE would impose restrictions on the permit that would prohibit over-diversion of the water rights.

8. Actions Needed to Implement/Ease of Implementation

In order to conjunctively manage water rights, permission of the State Engineer must be obtained, and modeling and/or other technical analyses will be needed to support an OSE application. The OSE and ISC must determine whether conjunctive management would impact the Rio Grande Compact. In locations other than Santa Fe (where surface and groundwater are

currently used), technical and environmental issues would need to be resolved, and cost estimates/financing studies would need to be completed regarding installation of surface diversions or new wells. A regional model that has the buy-in of neighboring water users that are likely to protest such an appropriation would be an essential foundation for proceeding with this alternative in Santa Fe and other areas of the Jemez y Sangre water planning region.

9. Summary of Advantages and Disadvantages

Conjunctive management of surface and groundwater rights would give water rights holders additional flexibility to efficiently manage their water rights. However, because this alternative may be perceived as allowing water rights holders to take additional water, other water users in the system would likely protest. Technical studies showing how much water would actually be diverted over time and how the health and life of the aquifer would be enhanced could increase the likelihood of acceptance by the OSE and by other water rights holders.

Specific advantages of conjunctive management are:

- Flexibility in managing water rights
- Larger available supply during dry years
- Low cost where surface and groundwater diversions already exist

Disadvantages of implementing conjunctive management include:

- Potential impairment and Rio Grande Compact issues
- Potential high costs where surface diversions must be built
- Potential necessity to increase reservoir storage space and/or other infrastructure to divert greater volumes of surface and groundwater

References

Daniel B. Stephens & Associates, Inc. (DBS&A). 2002a. *Alternative: Aquifer storage and recovery.* White paper prepared for the Jemez y Sangre Regional Water Planning Council, Santa Fe, New Mexico. July 2002.

DBS&A. 2002b. *Alternative: Manage well field / install new municipal/industry supply wells and/or domestic supply wells*. White paper prepared for the Jemez y Sangre Regional Water Planning Council, Santa Fe, New Mexico. July 2002.